Preventive Medicine

Health Hazard Appraisal in Patient Counseling

JOSEPH LaDOU, MD, JOHN N. SHERWOOD, MD, and LEWIS HUGHES, PhD,
Moffett Field, California

A program of annual health examinations was expanded to include counseling based on a computerized appraisal of individual patients' specific health hazard factors. Data obtained from a specially designed questionnaire, laboratory tests and a physical examination yielded a printout showing a number of weighted risk factors and their relation to ten leading causes of death as determined for that patient. From all of this information, a risk ("apparent") age was developed for the patient. The results were reviewed with each patient, and methods of correcting health hazards were stressed. A total of 488 persons were appraised, and 107 were randomly reappraised in less than a year, with the finding that the net risk age was reduced by 1.4 years. Such a reduction in risk age is significant; it indicates that appraisal-based counseling is an effective method of altering priorities of health practices.

HEALTH HAZARD APPRAISAL has been proposed as a method of outlining a preventive medicine program under the comprehensive care of the physician.[1] The principle is based on the fact that each person is faced with certain quantifiable health hazards as a member of a sex-age-race constituted group and, further, that these average risks may be applied to a patient if the clinician knows the patient's prognostic characteristics and the mortality experience of cohorts with similar prognostic characteristics. The proposal that early intervention of disease be accomplished through recognition and reduction of specific risks has been advanced by many proponents of prospective medicine.[2-5] The study discussed here was con-

ducted to determine the impact of health hazard patient counseling on risk reduction.

The health hazard appraisal is a method of using information from a patient's medical history, physical examination and x-ray and laboratory data to quantify his risk of death in an ensuing ten-year interval. The degree of risk is determined using tables that indicate the likelihood of death from specific causes for the average United States population. These tables, which are based on actual mortality data, were developed by Harvey Geller of the United States Public Health Service.[6,7] For every cause of death, the health hazard appraisal printout displays a set of weighted factors that may alter the prognosis of death from specific causes in either a positive or negative way. Typical factors of importance are blood pressure, weight and smoking habits for

TABLE 1.—*Ten-Year Mortality (Geller) Table for a White Man, Age 45*

Rank	Cause of Death	Chance in 100M of the Person Dying from This Cause
1	Arteriosclerosis, heart disease and chronic endocarditis	3,507
2	Malignant neoplasm of lungs	486
3	Vascular lesions of central nervous system	428
4	Cirrhosis of liver	370
5	Suicide	313
6	Motor vehicle accidents	313
7	Chronic rheumatic heart disease	220
8	Pneumonia	185
9	Malignant neoplasm of intestines and rectum	185
10	Other disease of the heart	150
11	Malignant neoplasm of stomach and esophagus	150
12	Hypertensive heart disease	150
13	Lymphosarcoma	93
14	Tuberculosis	93
	Other causes	2,524
	TOTAL CAUSES	9,200

heart disease; and mileage, alcohol and seat-belt use for automobile accidents. In this way, the outlook for each person is assessed against the "average" risk of death in the next ten years, from each cause, with specific prognostic altering that risk above or below the average.

Individual risk factors have been developed for each prognostic characteristic identified from the prospective studies in Framingham;[8] the study of cigarette use and lung cancer by Hammond and Horn[9] and numerous studies made by the health insurance industry, medical schools, hospitals and government agencies.[10,11] The resulting data were used to develop a system of prospective medicine and to prepare a risk factor manual (available to physicians from the Methodist Hospital of Indiana, 1604 North Capital Avenue, Indianapolis, Indiana 46202, or as a computer processed report from Interhealth, 2970 Fifth Avenue, San Diego, California 92103).

Table 1 is a Geller Table for an average 45-year-old white man in the United States. He has 9,200 in 100,000 chances of dying in the next ten years, with the highest risks being from heart disease, lung cancer, cerebrovascular accident, cirrhosis and suicide. Application of the risk factor manual to these data is demonstrated by the following example. If this man smokes one package of cigarettes per day and does not use alcohol, his overall risk would be increased to 11,000 in 100,000 in the next 10 years. Hence, his risk is

no longer that of a 45-year-old man, but similar to that of a 47-year-old man. Although abstaining from alcohol decreases his risks, smoking has resulted in a proportionately greater increase in risk of death—almost 2,000 chances in 100,000 more than an average person of his age. More important, if he stopped smoking, he could reduce his risks by 26 percent, giving him the risk factor of a 44-year-old man. With such information, patients can be made aware, in a quantitative way, of their risks and can begin a meaningful program to effect changes.

Methods and Background

Ames Research Center is the employer of 1,600 National Aeronautics and Space Administration personnel at Moffett Field, California. The average age of this population is 44. The majority of these workers participate in an annual health examination program given at the Ames Health Unit. Examinations include chest x-ray and electrocardiographic studies, submaximal stress electrocardiographic testing, laboratory profiles, physical examinations and health hazard appraisal.

For the health hazard appraisal, the examinee answers the questions in a six-page booklet, including questions regarding life-style, known diseases, family history, habits, emotional status and racial background. Physical data are inserted by Health Unit personnel, and the booklet, identified only by initials and a number, is forwarded to a central facility for analysis by a computer. Each patient is seen in a follow-up consultation two weeks after examination, and the results of the various tests are explained in full. During the interview, the physician discusses those factors relative to death risks that vary significantly from the norm. These data are summarized for the patient by a comparison of *present age* with *risk age* (as determined by the health hazard appraisal).

Changes in life-style or habits or the need for specific treatment are outlined where appropriate, and the patient is urged to consult his own physician, to whom a copy of all records is sent. The effects of compliance with recommended changes in life-style, such as the institution of exercise programs, weight loss, discontinuance of smoking and modification of alcohol use, are presented to the patient as a *potential age* to demonstrate the benefits of risk reduction.

At the time of this writing, 488 persons had

PATIENT NAME: MC

DATE: 09-20-73

DOCTOR NAME: Ames Health Unit

PATIENT ID: 000097747 M

AVERAGE	Risk/100,000	5,490	PRESENT AGE	40
PRESENT	Risk/100,000	2,936	RISK AGE	36
POTENTIAL .	Risk/100,000	2,652	POTENTIAL AGE	33

NOTE: The patient's risk may be increased by the following hazardous avocation: Drives motorcycle

---

CAUSE: Accidents, Motor Vehicles

AVERAGE RISK   339 (1.0)
PRESENT RISK   305 (.9 x Avg)
POTENTIAL RISK   108 (.3 x Avg)

CONTRIBUTING FACTORS	Present Risk
Alcohol: 1-2 drinks/wk	1.0
Mileage - 10,000	.8
Seat Belts: less than 10% usage	1.1
Drives motorcycle	

POTENTIAL RISK WITH TREATMENT
None before driving   .5

Always use seat belts   .8

CAUSE: Arteriosclerotic Heart Disease

AVERAGE RISK   1,861 (1.0)
PRESENT RISK   130 (.1 x Avg)
POTENTIAL RISK   74 (.1 x Avg)

CONTRIBUTING FACTORS	Present Risk
B.P. (Avg) -- 122/080	.4
Chol (Avg) -- 180 Mg%	.5
Exercise: some activity	1.0
Smoking: nonsmoker	.5
Weight - 06% overweight	.8

POTENTIAL RISK WITH TREATMENT

	.4
	.5
Exercise as directed	.5
	.5
Reduce to average	.8

CAUSE: Cirrhosis of Liver

AVERAGE RISK   304 (1.0)
PRESENT RISK   61 (.2 x Avg)
POTENTIAL RISK   30 (.1 x Avg)

CONTRIBUTING FACTORS	Present Risk
Alcohol: 1-2 drinks/wk	.2

POTENTIAL RISK WITH TREATMENT
Stop drinking   .1

Figure 1.—Health hazard appraisal computer printout for a 40-year-old white man.

been counseled in this manner. Of these, a random group of 107 were given repeat appraisals within a year, and the results—capsulized as the risk age—were compared with the first appraisal.

Figure 1 shows an Interhealth computer printout for a 40-year-old, white man. The average risk of death in the next ten years, as derived from the Geller tables, is 5,490 chances in 100,000. Because of favorable health practices and medical history, however, his risks are significantly reduced. The present risk of 2,936 in 100,000 is derived from the health hazard appraisal and is equated to a risk age four years less than his present age. Compliance with the various recommendations shown in the right-hand column of the printout would decrease this person's risk to 2,652 in 100,000, and offer him a potential age of 33. Information such as this has been used to

develop the Ames Health Unit system for patient counseling for risk reduction.

Results

The first 50 patients were timed as they completed the health hazard appraisal test booklet. The testing time ranged from 11 to 24 minutes, with an average of 17 minutes. Seven out of 495 patients refused to participate in the program. Occasionally, patients left questions unanswered, but all those participating consented to the use of average values for the omitted areas to allow the remainder of the health hazard appraisal to be evaluated.

Averages of the results of the Ames health hazard appraisals are shown in Table 2. The close approximation of average *present age* and *risk age* indicates the similarity of the Ames Research Center group to the larger United States popula-

TABLE 2.—*Average of Health Hazard Appraisal Results for the Ames Research Center Population*

Number of Patients	Present Age	Risk Age	Potential Age
488	48.45	48.37	43.45

TABLE 3.—*Average of Health Hazard Appraisal Results of 107 Examinees Evaluated on Repeat Periodic Examination*

	Present Age	Risk Age	Difference (between present and risk ages)	Potential Age
Initial HHA ...	49.43	49.56	+0.13	44.69
Repeat HHA .. (N = 107)	50.06	48.66	−1.40	44.34

tion. However, the standard deviation of *risk age* from *present age* is 4.24 years. In those cases where risk age was greater than present age, this deviation would suggest an added value in patient counseling. For the group of 488, the average *potential age* is fully five years less than *present age*. This finding reinforces the value of patient counseling.

The value of the health hazard appraisal in motivating patients to improve their health practices can be assessed by comparing the average variance of present age with risk age between initial testing and annual retesting. In the Ames Health Unit, 107 patients have been retested and the results are shown in Table 3. For these patients, risk age was found to be 0.13 years greater than present age in the initial health hazard appraisal, but 1.40 years less than present age in repeat testing. This difference is highly significant, with a "p" value less than .001. It represents an average of 32 percent of the difference between present age and potential age. The potential age for this group when retested remained five years less than risk age.

A questionnaire was used to assess patient acceptance of the health hazard appraisal. Eighty percent of a sampling of 162 persons indicated full acceptance of the program and a desire to be retested annually. Half of the subjects interpreted their test results as indicative of a need for change in their health practices. Eighty percent indicated their intention to make some or all of the neces-

sary changes to achieve a lessened risk of death in the next ten years.

Comment

Mortality statistics would appear to provide an unlikely means of patient counseling in health practices. The opportunity to alter the risk of death on a ten-year prognostic basis, however, is a dynamic function of compliance with patient counseling. The physician has learned that statistical probabilities put various risk factors into an order of priorities that is easily understood by the patient. The importance of seat belts as compared with exercise, weight control and other health practices tended to add to the total value of patient counseling by adding subject material frequently considered by physicians to be outside the field of medicine. The degree of patient acceptance of the health hazard appraisal was illustrated by the compliance of the group undergoing periodic retesting and by their willingness to repeat the health hazard appraisal annually.

Health hazard appraisal will become an increasingly important adjunct to patient counseling as risk factors are further quantified. The addition to health hazard appraisal of risk factors such as personality typing and the impact of social changes on future health will be important developments.

REFERENCES

1. Sadusk JF, Robbins LC: Proposal for health-hazard appraisal in comprehensive health care. JAMA 203:1108-1112, Mar 25, 1968
2. Robbins LC, Hall JH: How to Practice Prospective Medicine. Indianapolis, Slaymaker Enterprises, 1970
3. Dubos R: Reason Awake, Science for Man. New York, Columbia University Press, 1970
4. Hall JH, Robbins LC, Gesner NB: Whose health problem? Postgrad Med 51:114-120, 1972
5. Robbins LC, Egger RL: Health maintenance, chap 11, In Conn HF, Rakel RE, Johnson TW: Family Practice. Philadelphia, WB Saunders Co, 1973
6. Geller H: Vital Statistics of the United States, 1960, Vol 2, Mortality, Part A. Washington, DC, U.S. Government Printing Office, 1963
7. Geller H: Probability Tables of Death in the Next Ten Years from Specific Causes. Philadelphia, Jefferson Medical College, 1966
8. Gordon T, Kannel WB: Premature mortality from coronary heart disease—The Framingham study. JAMA 215:1617-1625, 1971
9. Hammond ED, Horn D: Smoking and death rates—Report on 44 months of follow-up of 187,783 men. JAMA 166:1159-1172, Mar 8, 1958; 1294-1308, Mar 15, 1958
10. Robbins LC, Hudson CR: Seventh Annual Meeting: Prospective Medicine and Health Hazard Appraisal—A report. Indianapolis, Methodist Hospital of Indiana, Feb 1971
11. Gesner NB: Health hazard appraisal—A tool for the practicing physician, In Proceedings Conference of Actuaries in Public Practice, Vol 21, 1971-1972